

# Section 8 Remedial Action Objectives and Remedial Goals

The Selected Remedy described in this ROD is intended to be the final remedial action for the BPSOU. EPA has identified site-specific human health and environmental remediation objectives and goals for groundwater, surface water, soils, indoor dust, and mining-related wastes in the BPSOU. Remedial Action Objectives (RAOs) are the final media-specific (e.g., solid media, surface water, etc.) statements regarding the objectives to be achieved by the remedial action. They address the various COCs, media of concern, exposure pathways and receptors, and current and likely future land use in the OU. Remedial Goals (RGs) are numerical cleanup goals for environmental media. The RGs are based on ARARs or are the results of baseline risk assessments for the BPSOU. Remedial actions implemented for the purpose of meeting RGs usually result in attainment of RAOs.

RAOs and RGs were prepared by EPA in accordance with NCP regulations, relevant guidance, and in consultation with DEQ. Consideration was also given to suggestions from the PRP Group and other interested parties and current site conditions. The Preliminary RAOs and RGs initially set by EPA were updated as the RI/FS progressed. The ROD establishes the final RAOs and RGs.

RAOs and RGs for air are not addressed as part of the BPSOU as stand-alone goals, although certain air standards may be ARARs during the conduct of cleanup actions (e.g., dust control). Air is not addressed because any chronic violations of air standards from CERCLA sources are not a pathway of concern at the OU.

In-stream sediments are not specifically addressed in the RGs. However, one goal of the previous response actions and future remedial actions for the OU is to eliminate or minimize sources of contamination to Silver Bow Creek sediment (i.e., surface water transport of contaminated soils or waste) such that excessively contaminated sediments are not present. Sediments were largely addressed during the Lower Area One ERA when the Silver Bow Creek floodplain was reconstructed and when the subdrain was installed in Metro Storm Drain. Additional sediments, defined geographically rather than in reference to specific action levels for sediments, will be addressed through sediment removal along the stream reach between the confluence and Lower Area One, as described in this ROD.

The following specific objectives were developed for each media. The objectives specify the COCs and the exposure routes and receptors at issue for cleanup. The objectives are followed by RGs in the form of ARARs or acceptable levels or ranges of levels for each exposure route.

## 8.1 Solid Media

Humans are the primary current and future receptors of arsenic and metals from contaminated soils, indoor dust, waste rock, and tailings (solid media) within the OU.

The primary exposure pathways are direct ingestion, incidental ingestion, and dermal contact with these media and the indirect inhalation of contaminated airborne indoor dust.

Solid media are a source of contamination to the underlying alluvial and bedrock aquifers via leaching of contaminants from solid media and the subsequent downward migration through the unsaturated (vadose) zone. Contaminated solid media are also a source of arsenic and metals to surface water within the OU via runoff and other transport.

Secondary exposure pathways for humans are potential direct ingestion, incidental ingestion, and dermal contact with surface and groundwater contaminated by solid media. Aquatic receptors are exposed to arsenic and metals from solid media in surface water and the surrounding environment. For solid media, the COCs are arsenic, lead, and mercury.

### **8.1.1 Remedial Action Objectives**

The RAOs for contaminated solid media in the OU are to:

- Prevent the ingestion of, direct contact with, and the inhalation of, contaminated soils, indoor dust, waste rock, and/or tailings or other process waste that would result in an unacceptable risk to human health assuming current or reasonably anticipated future land uses.
- Prevent releases of contaminated solid media to the extent that they will not result in an unacceptable risk to aquatic environmental receptors.
- Prevent releases of contaminated water from solid media that would result in exceedances of the Montana State Water Quality Standards for surface water.
- Prevent releases of contaminated water from solid media that would result in exceedances of the Montana State Water Quality Standards for groundwater, except where ARAR waivers are appropriate and other means to protect from associated risks are available.
- Remediate contaminated solid media to the extent that it will not result in an unacceptable risk to human health and/or aquatic environmental receptors.
- Prevent release of contaminated water from solid media that would result in degradation of surface water, in accordance with the surface water RGs.

### **8.1.2 Remedial Goals**

Human health risks from exposure to mining related lead and cadmium were evaluated through a series of baseline risk assessment documents that concluded in 1994 as described in Part 2, Section 7 of this ROD. That evaluation determined that human health risks at the OU from exposure to cadmium were not unacceptable to

EPA. Actual and potential risks from exposure to high levels of lead at the OU, however, were unacceptable.

In 1994, the baseline risk assessment for lead was conducted to evaluate potential human health risks associated with exposure to lead within residential areas of the BPSOU (CDM 1994). EPA derived action levels for lead at 1,200 mg/kg in residential yards and play areas (i.e., receptor areas) and 2,300 mg/kg at waste rock dumps or other source areas outside of residential areas to maintain a blood lead level of 10 µg/dl or less for at least 95 percent of the children between the ages of zero and 6 years. These action levels have been used to determine ongoing response actions, including use by Butte-Silver Bow County as part of the lead abatement program.

EPA completed an evaluation of the potential risks to human health from exposure to arsenic contaminated soil and waste rock within the OU. Three pathways of contact with mining-related arsenic were considered: ingesting or inhaling soils, indoor dust, and water and absorbing arsenic through the skin. Based on the risk assessment, EPA set action levels for arsenic. The arsenic action level for residential areas and rail beds that transect residential areas is 250 mg/kg. The commercial/industrial action level for arsenic is 500 mg/kg. The arsenic action level for open space areas that may be used for recreational purposes is 1,000 mg/kg.

In 2003, EPA finalized an additional evaluation of the potential human health risks to children and adults living in Walkerville related to exposure to arsenic, lead, and mercury in outdoor soil and indoor dust. Exposure scenarios considered included: ingestion of outdoor soil and indoor dust (basement soil, living area dust, and attic dust); inhalation of airborne dust from soil and indoor dust; and inhalation of indoor air vapor (mercury only). Based on the results of the Walkerville residential risk analysis, EPA established an indoor residential action level for mercury vapor of 0.43 micrograms per cubic meter (µg/m<sup>3</sup>) and an action level of 147 mg/kg for mercury in residential soil. Previously established residential action levels for arsenic (250 mg/kg) and lead (1,200 mg/kg) were determined to be protective for exposure to indoor dust, and were not changed.

All of these levels apply to areas where a completed pathway of exposure is present. For attic dust, a pathway of exposure is present when attics are remodeled and used or are otherwise altered or broken down in ways that create exposure. RGs for arsenic, lead and mercury will apply to attic dust when exposure pathways are present.

## **8.2 Groundwater**

EPA's September 4, 2001 groundwater risk assessment addendum found unacceptable risk to human receptors from the potential use and ingestion of contaminated alluvial groundwater at the OU, primarily because of arsenic and lead contamination (CDM 2001). The RAOs and human health RGs associated with groundwater contamination at the OU are based on this potential risk. However, the general industrial nature of the area where groundwater exists, along with existing and planned institutional

controls regarding groundwater, may prevent the actual domestic use of the alluvial groundwater in Butte.

Groundwater COCs are arsenic, cadmium, copper, lead, mercury, and zinc.

### 8.2.1 Remedial Action Objectives

The remedial action objectives for contaminated groundwater are:

- Prevent ingestion of or direct contact with contaminated groundwater that would result in unacceptable risk to human health.
- Prevent groundwater discharge that would lead to violations of surface water ARARs and RGs for the BPSOU.
- Prevent degradation of groundwater that exceeds current standards.

### 8.2.2 Remedial Goals

Montana classifies groundwater into Classes I through IV based upon its specific conductance and establishes the groundwater quality standards applicable with respect to groundwater classification. Concentration of dissolved substances in Class I or Class II groundwater may not exceed the human health standards listed in the current Montana Numeric Water Quality Standards Circular DEQ-7 (DEQ-7) and shown in Table 8-1. None of the DEQ-7 levels are less stringent than the federally promulgated MCLs or non-zero MCLGs, so those standards are not identified here.

**Table 8-1**  
**DEQ-7 Standards for Groundwater**  
**Record of Decision**  
*Butte Priority Soils Operable Unit*  
*Silver Bow Creek/Butte Area NPL Site*

<b>COC</b>	<b>Standard (Dissolved)</b>
Arsenic	10 µg/L
Cadmium	5 µg/L
Copper	1,300 µg/L
Lead	15 µg/L
Mercury	2 µg/L
Zinc	2,000 µg/L

For concentrations of parameters for which human health standards are not listed in DEQ-7, ARM 17.30.1006 allows no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class I or

Class II water. RGs for groundwater may be revised downward, in order to achieve surface water quality standards and RGs. For arsenic, the current Federal MCL of 10 µg/L is the appropriate RG for arsenic in groundwater, along with the recently promulgated State standard of 10 µg/L.

EPA has evaluated the Technical Impracticability (TI) Evaluation document for the alluvial aquifer – a document that EPA completed prior to the release of this ROD – and all other relevant information in the Administrative Record regarding groundwater. EPA has waived the ARAR RGs for groundwater for the alluvial aquifer identified in the TI Evaluation and in this ROD. The groundwater RGs identified in Table 8-1 and this section of the ROD therefore apply only to groundwater outside of the waiver area, which may be defined during remedial design. Further explanation for the ARAR waiver is provided in Section 12 of Part 2 of this ROD.

### **8.3 Surface Water**

There are a number of ARARs related to surface water and storm water control for the OU. The main requirements for the surface water regulations are compliance with Montana's water quality standards (DEQ-7, February 2006). EPA has set as its objective compliance with standards continuously throughout the entire reach of Silver Bow Creek in the OU and downstream, during base flow and storm water conditions.

The State has designated uses for Silver Bow Creek and has promulgated specific standards accordingly. These standards are as stringent as, or more stringent than, the federal water quality criteria. The most stringent human health or aquatic water quality criterion is applied. Silver Bow Creek must meet human health standards and not allow zones of acute aquatic life toxicity (i.e., mixing zones) or allow the aquatic life chronic 4-day average and the acute 1-hour (instantaneous) concentrations to exceed the DEQ-7 aquatic life criteria.

The recently-lowered federal human health standard for arsenic of 10 µg/L was adopted by the State in January 2006. This standard is the correct arsenic ARAR for Silver Bow Creek.

Silver Bow Creek (main stem) from the confluence of Blacktail Creek to Warm Springs Creek is classified "I" for water use. This classification was established to provide a framework for improving waters that have been impacted by human activities with the goal to return waters to beneficial uses.

The Metro Storm Drain (historic Silver Bow Creek channel) from the concentrator tailings pond down stream to Blacktail Creek has no regulatory classification. Blacktail Creek and Grove Gulch are classified "B-1" for their water use. Under both classifications, surface water quality will be restored and/or maintained to support the following uses: drinking; culinary; food processing; bathing; swimming; recreation, growth and propagation of fish (specifically salmonid for B-I creeks) and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial

water supplies. These beneficial uses are generally considered supported when the concentration of toxic, carcinogenic, or harmful parameters in these waters do not exceed the applicable standards specified in the DEQ-7 Circular.

Surface water COCs are aluminum, arsenic, cadmium, copper, iron, lead, mercury, silver, and zinc.

### **8.3.1 Remedial Action Objectives**

The RAOs for contaminated surface water are to:

- Prevent ingestion or direct contact with contaminated surface water that would result in an unacceptable risk to human health.
- Return surface water to a quality that supports its beneficial uses.
- Prevent source areas from releasing contaminants to surface water that would cause the receiving water to violate surface water ARARs and RGs for the OU and prevent degradation of downstream surface water sources, including during storm events.
- Ensure that point source discharges from any water treatment facility (e.g., water treatment plant, wetland, etc.) meet ARARs.
- Prevent further degradation of surface water.
- Meet the more restrictive of chronic aquatic life or human health standards for surface water identified in Circular DEQ-7 (Table 8-2) through the application of B-1 class standards, as more specifically described below.

### **8.3.2 Remedial Goals**

#### **8.3.2.1 Point Sources**

For point sources the chronic aquatic life and human health standards specified in Circular DEQ-7 or other applicable standards would apply, as described in EPA's February 2, 1999 letter to ARCO (EPA 1999b). Because the quality of water in Silver Bow Creek has improved to the point where I classification computations are no longer relevant or necessary, new point sources must meet the Circular DEQ-7 standards (Table 8-2). For B-1 waters, the I classification system for new point sources does not apply, and the standards specified in Circular DEQ-7 or other applicable standards would apply to both point source discharges or ambient water.

#### **8.3.2.2 In Stream Standards**

For in-stream standards and RGs, state water quality standards form the basis of the RGs. The arsenic RG is based on the maximum contaminant level (MCL), which was adopted by the state. None of the DEQ-7 levels are less stringent than the federally promulgated MCLs or non-zero MCLGs, so those standards are not identified here. The DEQ-7 standard for aluminum is based on dissolved concentrations. All other standards are measured based on the total recoverable amount of the identified chemical. For storm water run-off or "wet weather flows", acute aquatic life standards

promulgated under Circular DEQ-7 (February 2006) are the appropriate performance standards.

Table 8-2 shows the applicable water quality standards with which any remedial action must comply.

**Table 8-2**  
**Surface Water Quality Standards**  
**Record of Decision**  
**Butte Priority Soils Operable Unit**  
**Silver Bow Creek/Butte Area NPL Site**

COC	DEQ-7 Standard	Standard <sup>1</sup> (Total)
Aluminum <sup>2</sup>	Acute	750 µg/L
	Chronic	87 µg/L
Arsenic <sup>3</sup>	Acute	340 µg/L
	Chronic	150 µg/L
	Human Health	10 µg/L
Cadmium	Acute	0.52 µg/L <sup>1</sup>
	Chronic	0.097 µg/L <sup>1</sup>
Copper	Acute	3.79 µg/L <sup>1</sup>
	Chronic	2.85 µg/L <sup>1</sup>
Iron	Chronic	1,000 µg/L
Lead	Acute	13.98 µg/L <sup>1</sup>
	Chronic	0.545 µg/L <sup>1</sup>
	Human Health	15 µg/L
Mercury	Acute	1.7 µg/L
	Chronic	0.91 µg/L
	Human Health	0.05 µg/L
Silver	Acute	0.374 µg/L <sup>1</sup>
Zinc	Acute	37 µg/L <sup>1</sup>
	Chronic	37 µg/L <sup>1</sup>
<b>Notes</b> 1. Standards for cadmium, copper, lead, silver, and zinc are hardness-dependent. Value shown is calculated at a hardness of 25 mg/L (Montana Numerical Water Quality Standards, Circular DEQ-7, February 2006). 2. The DEQ-7 standards for aluminum refer to the dissolved fraction. 3. The State adopted the Federal standard for arsenic in January 2006.		

Nitrate and fluoride in groundwater or surface water are not associated with mining in this OU, and therefore are not included on this list. Response actions to address these contaminants are outside the scope of the Selected Remedy.

In addition, the dissolved oxygen concentration must not be reduced below 3.0 mg/L; the pH must be maintained within a range of 6.5 to 9.5; no increases are allowed in the

physical properties (e.g., temperature, turbidity, solids [floating or suspended], color, etc.) which will or are likely to create a nuisance or render the water harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or the wildlife; and no discharges of toxic carcinogenic, or harmful parameters may commence or continue which lower or are likely to lower the overall quality of these waters.

Finally, all substantive requirements of the Montana Pollutant Discharge Elimination System must be adhered to for point sources addressed or created in the remedial process.

For B-1 classification waters, non-degradation rules require that any surface water below the above standards must be maintained and protected unless degradation is allowed under the non-degradation rules.